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THE IMPACT OF IMPERFECT INFORMATION ON THE WAGES OF NATIVE-BORN AND IMMIGRANT WORKERS: EVIDENCE FROM THE 2006 CANADIAN CENSUS

Abstract:

This paper empirically examines how imperfect information about wage offers and reservation wages among employees and employers respectively impacts on the wages of Canadian born and immigrant workers. We estimate these effects from 2006 census data using a two-tier stochastic wage frontier. Our main contributions are: first, the use 2006 census data allows us to examine how the international transferability of immigrant human capital (or the lack of it) impacts on worker and employer information - this could not be done with earlier censuses, but is a critical factor that separates the labour market experience of immigrants (especially newcomers) from that of native-born Canadians; second, we adopt a more general approach to information gaps by re-parameterizing the frontier model to incorporate the impact of individual differences on labour market information; and third, we allow worker and employer information gaps to vary due to industry fixed effects. Our findings show that Canadian-born and immigrants with similar characteristics tend to experience quite similar wage gaps in the aggregate. While those gaps show significant variation across some industries for both immigrants and Canadian-born workers, and wage gaps due to worker imperfect information are also similar both groups, wage gaps driven by employer imperfect information are much larger among immigrants. As well, the results show that the variability in the amount of information that workers and employers possess is clearly more substantial among immigrants, thereby pointing to greater uncertainty about their wage outcomes. Our analysis of immigrants shows that while the effects of acquiring their degree prior to migration increases the size of wage gaps due to employer and worker imperfect information, these impacts are relatively modest when compared to those arising from a lack of language skills.

Keywords:

imperfect information, two-tier wage frontier, wage gaps, Canadian-born and immigrant workers, 2006 census

JEL Classification: J01, J24, J30

I. INTRODUCTION

This paper empirically examines how imperfect information about wage offers and reservation wages among employees and employers respectively impacts on the wages of Canadian workers. These information gaps, which can persist because employees and employers face information-acquisition costs, can be expected to lead to wage gaps as workers accept wages below the highest available offers, and employers hire workers above reservation wages. The larger any one gap, the greater the wage inequality resulting from markets not rewarding similar individuals in a similar way, ceteris paribus. Observed wages would then reflect the interaction between two opposing tendencies, and could settle above or below the full-information wage, depending upon the degree of asymmetry on the two sides of the labour market with regard to information. The aim of this paper is to measure how information gaps vary across Canadian-born and immigrant workers, and how those translate into wage gaps, using data from the 2006 census. We model these effects using the two-tier stochastic wage frontier suggested by Polachek and Yoon (1987, 1996), and subsequently used by others in labour market studies – see for instance, Poggi (2010), Murphy and Strobl (2008), Kumbhakar and Parmeter (2009), Sharif and Dar(2007). The two-tier frontier has also found many interesting applications in other contexts as well - see Papadopoulos (2014) for a sampling.

There has been little work in this area in the context of Canada. This paper extends previous work (Sharif and Dar, 2007) in three ways. First, the 2006 census allows us to examine how the international transferability of immigrant human capital (or the lack of it) impacts on worker and employer information. This could not be done with earlier censuses, but is a critical factor that separates the labour market experience of immigrants (especially newcomers) from that of native-born Canadians. Second, we adopt a more general approach to information gaps, by re-parameterizing the frontier model to incorporate the impact of individual differences on labour market information. Third, worker and employer information gaps are likely to vary by industry of employment, since industry characteristics affect the costs of labour market search for both employer and employers. For example, in industries where the incidence of unionization is high (manufacturing), information gaps would be smaller than in industries where this is low (retail trade), other things being equal.

The rest of the paper is organized is as follows. In Section II, we outline the empirical model and the estimation strategy. Section III describes the data and contains a discussion of the results. Section IV concludes.

II. MODELLING INFORMATION GAPS: THE TWO-TIER WAGE FRONTIER

The basic theoretical model upon which the two-tier frontier is based, is one in which labour markets are competitive, but suffer from imperfect information. The theoretical principles underlying information gaps and the two-tier wage frontier have been formally developed elsewhere (Polacheck and Yoon, 1987), so in what follows we provide a synopsis of the main

ideas underlying the modelling of information gaps from an empirical standpoint, based on (Polacheck and Yoon, 1987) and the discussion in Sharif and Dar (2007).

In the markets for labour, as in other markets, participants on both the demand side (employers) as well as the supply side (employees) lack full information. From the perspective of employees, they do not know the maximum wage that employers are willing to pay, and hence might accept employment at a lower wage. This wage shortfall is, thus, the result of "ignorance" on the part of workers. Similarly, employers lack information on the reservation wages of workers and hence the wage they might end up paying is higher than the minimum required to attract workers. The resulting wage gap is, therefore, the result of "ignorance" on the part of employers. Each of these information gaps can cause large variations in wages even among similar individuals, a variation that is in addition to otherwise purely random variations one might expect even in the absence of any information gaps. To be sure, there would be an incentive to close information gaps; however, efforts to do so are not costless, so that complete elimination of such gaps would not occur, and the extent to which the gaps are closed would vary across individual employers and employees. As noted by Polachek and Yoon (1987, p. 300), the manifestation of market inefficiency is frictional unemployment and markets not rewarding similar individuals in similar ways, not necessarily that mean observed wages deviate too much from the full-information (competitive) wage.

It is not clear, a priori, how employee and employer information gaps might vary across various population groups (after controlling for various factors), since the outcome is conditional on the volume of information and the cost of acquiring it, from the perspective of both workers and employees. For instance, workers with higher levels of education and training may experience lower worker information gaps than less educated workers due to a variety of reasons, from high reservation wages (due to higher discount rates), and greater search efficiency, to better access to information networks (Hofler and Murphy, 1992). In addition, as Hofler and Murphy further note, unemployment benefits act as a subsidy that lowers the marginal cost of search, so those receiving employment insurance might experience smaller wage gaps. As well, as noted earlier, from the perspective of employers, unions provide information about worker reservation wages to firms, and this would likely lower wage gaps resulting from employer ignorance. However, not all predictions of search theory are unambiguous, primarily because, in many instances, it is not clear how information acquisition affects costs relative to gains. As a result, one cannot ascertain a priori, how employee and employer information gaps would vary across individuals and population strata. For instance, in urban areas and/or among large population groups, the volume of information is large and hence this would tend to widen gaps by raising search costs. However, if population density is high, this could lower the cost of acquiring information and narrow information gaps. On balance, how these two opposing tendencies will play out is uncertain a priori, and is an empirical question. In general, the volume of potential information and/or the costs of acquiring it likely vary across population groups, as well as for employers of any population group and this would determine how information gaps might differ across those groups. In this regard, it is worth noting that since information on reservation wages is likely to

be more private than information on wage offers, the greater the diversity of individuals, in terms of skill and occupation, the greater employer information gaps are likely to be.

Immigrants are a population group of special interest. It is well-recognized that they might face a number of disadvantages upon migration because of their unfamiliarity with host country labour markets and institutions, a lack of access to occupational networks, and the imperfect transferability of human capital acquired abroad. As a result, one would expect that new immigrant workers would have greater costs of acquiring information, and would thus display larger information gaps than the native-born with the same bundle of characteristics. As well, it could be argued that as the length of residence increases, if these workers are better able to use formal as well as informal labour market institutions in their search behaviour, the marginal cost of search falls, and their information about wage offers increases thereby lowering wage gaps (see Daneshvary et al., 1992 for details). Daneshvary et al. argue that worker assimilation can best be studied by determining empirically whether or not the average information gap declines as the length of residence in the host country increases. This process would also likely be facilitated by the positive selectivity of immigrants. Chiswick (1978, 1999) notes that immigrants are positively selected to the extent they are tend to be highly motivated and for economic migrants, the immigration system evaluates potential immigrants on their economic potential. These traits also make them relatively mobile and, hence, more flexible, perhaps implying that any wage disadvantage from information costs would erode quickly.

On the demand side of the labour market, employers too could also face higher costs of information gathering when immigrants are new, come from non-traditional sources and bring foreign-acquired qualifications and skills, which are unfamiliar to firms. In that case, one would also expect employer wage gaps to be larger for new immigrants compared to the native-born. At the same time, one can make an argument that where immigration has resulted in well-established immigrant communities, these gaps could be narrower if individuals seek employment in ethnic labour markets, and/or if certain immigrant groups are more concentrated in certain occupations, since the costs of acquiring information in such markets could be lower. In Canada, migrants tend to be concentrated in major urban centres, and many work in ethnic labour markets. This would likely mean that employer (as well as worker) information gaps could be lower.

The above factors suggest that we cannot say, a priori, how immigrant groups would compare with native-born groups in terms of wage gaps, and how those gaps change over time. The empirical work we undertake is intended to shed some light on these questions.

At the empirical level, measuring information gaps has proceeded using the concept of the wage frontier. Letting w_i^* stand for the log wage that individual *i* could earn in the absence of any information gaps, we can represent the wage frontier as:

$$w_i^* = \boldsymbol{\alpha' x_i} + u_i \qquad (1)$$

where $\boldsymbol{x}$ is a vector of human capital and other factors that allow the full-information wage w^* to differ across individuals, and u is the usual random disturbance term, assumed to follow a normal distribution with zero mean and constant variance σ^2. With worker and employer information gaps, the two-tier wage model proposed by Polachek and Yoon (1987) can be written as:

$$w_i = \boldsymbol{\alpha' x_i} + u_i + v_i + e_i \qquad (2)$$

where w is the actual log wage, and the unobserved variables v and e represent worker ignorance and employer ignorance respectively, with the restrictions that $v \leq 0$ and $e \geq 0$. Following Polachek and Yoon (1987), we assume that both v and e follow exponential distributions with means and variances given by: $E(v) = -\lambda$, $var(v) = \lambda^2$, $E(e) = \theta$, and $var(e) = \theta^2$. Thus, $-\lambda$ and θ measure average worker and employee ignorance respectively. If we express the wage in its natural units, we can re-write (2) as:

$$W_i^* = exp(\boldsymbol{\alpha' x_i} + u_i)$$

The actual wage then can be written as:

$$W_i = exp(\boldsymbol{\alpha' x_i} + u_i + v_i + e_i)$$

Thus, actual wages relative to frontier wages are:

$$(W_i/W_i^*) = exp(v_i)exp(e_i)$$

Taking the expectation of this equation, we can write:

$$E(W_i/W_i^*) = E[exp(v_i)]E[exp(e_i)] \qquad (3)$$

Equation (3) measures the overall mean level of worker and employer information. It is not difficult to show that the mean level of imperfect information, as measured by the average wage with worker and employer ignorance respectively is:

$$E[exp(v_i)] = [1/(1+\lambda)] \text{ and } E[exp(e_i)] = [\theta/(1-\theta)] \qquad (4)$$

The mean overall wage due to worker and employer ignorance can be obtained as the product of the two expressions in (4).

In order to estimate worker (and employer) information gaps, the two-tier stochastic frontier can be estimated by the maximum likelihood method. Assuming *u*, *v*, and *e* are independent, Polachek and Yoon (1987 have shown the log likelihood function (L) to be:

$$L = T\ln(\sigma^*\lambda^*\theta^*)/(\lambda^* + \theta^*) + \sigma^*\lambda^*\Sigma\mu_i + (T/2)\,\lambda^{*2} + \Sigma\log\xi_i \qquad (5)$$

where $\sigma^* = (1/\sigma)$, $\lambda^* = (\sigma/\lambda)$, $\theta^* = (\sigma/\theta)$, and $\mu_i = w_i - \boldsymbol{\alpha' x_i}$, is the composite error $(u+w+e)$. As well, $\xi = 1 - \Phi(\sigma^*\mu + \lambda^*) + [1 - \Phi(-\sigma^*\mu + \theta^*)]\exp[1 - 0.5(2\sigma^*\mu + \lambda^* - \theta^*)(\sigma^* + \theta^*)]$, where $\Phi(.)$ is the cumulative standard normal distribution function.

The maximization of (5) yields the maximum likelihood estimates of all relevant parameters, including those needed to estimate the wage gaps implied by equation (4).

One disadvantage of the above two-tier model is that we cannot estimate employee and employer information gaps that are individual-specific. In our study, we can go further by following the method proposed by Groot and Oosterbeek (1994), which allows the information parameters λ^* and θ^* to vary by individual characteristics. That is, we can write:

$$\lambda^* = \boldsymbol{\delta' z} \quad \text{and} \quad \theta^* = \boldsymbol{\gamma' z} \qquad (6)$$

where ***z*** is a vector of variables representing individual characteristics, and could include variables that appear in the vector ***x.*** With this parameterization, worker and employer information gaps would vary by individual within and across the population groups studied. An added advantage is that this approach gives information on average as well as marginal differences in labour market information. With the addition of (6) to the model, it can be shown that worker and employee information gaps are now given by:

$$E[\exp(v_i)] = \boldsymbol{\delta' z}/(\sigma + \boldsymbol{\delta' z}) \text{ and } E[\exp(e_i)] = \boldsymbol{\gamma' z}/(\boldsymbol{\gamma' z} - \sigma) \qquad (7)$$

The mechanics of the maximum likelihood estimation method can be adapted to deal with this extension, and would yield estimates of the vectors $\boldsymbol{\delta}$ and $\boldsymbol{\gamma}$, which along with an estimate of

σ and given values of variables in the vector ***z***, would permit obtaining the wage gaps using (7).

III. THE DATA AND RESULTS

Description of the Variables and Data

In specifying the vector ***x*****,** we adopt the standard convention of including human capital variables - schooling and labour market experience. The former is measured by a vector of dummy variables which flag the level of education attained, while the latter is measured using a person's age in years (and its square). In the immigrant regression, we introduce an interaction term between the education level attained (beyond high school) and a dummy variable that is one if an individual obtained their highest degree abroad. This would allow for the imperfect substitutability between foreign-acquired and Canadian-acquired human capital. We additionally control for an individual's occupation, since it a worker's occupation that is the channel through which human capital translates into earnings (see, for instance, Chiswick and Miller, 2007). As well, gender exerts an important impact on wages. The CMA and gender variables are introduced as dummy variables. For the vector ***z***, we include variables that would affect the amount of worker and employer information. The industry of employment would affect the amount of information workers and firms would acquire. To capture this impact, we use the North American Industrial Classification, which classifies industries into 20 groups in the census data file. These industries range from agriculture and related industries, to manufacturing, construction, and a number of service industries such as retail trade, health, and education. As well, we include the location and gender variable, and for immigrants, language ability and length of residence in Canada that can be important factors determining information gaps. The precise definitions of all variables in our empirical analysis are given in Table 1.

Table 1: Variable Definitions

Variable	Definition
Wages	Weekly earnings ($) from employment
HS -	Less than a high school education (DV=0) - default
HSCert	High school plus certificates (DV=1)
Bac +	A bachelors degree plus certificates (DV=1)
Mas +	A masters degree plus doctorate plus (DV=1)
Manag	Managers (all levels) (DV=1)
Profs	Professionals, semi-professionals and technicians (DV=0) - default

Super	Supervisors, administrative and senior clerical personnel (DV=1)
Skint	Skilled sales & service personnel, intermediate sales/service personnel, skilled crafts and trades workers, other sales and service personnel (DV=1)
Cler	Clerical personnel (DV=1)
Man	Manual workers (semi-skilled plus other) (DV=1)
Language	Knows of one or both official languages (DV=0), 1 if not.
Gender	Female (DV=1), 0 if male
CMA	Resident of a Census Metropolitan Area (DV=1)
Immigrant cohorts	Those who arrived in Canada during 2001-2006, 1996-2000, 1991-1995, 1986-1999, and those who came before 1986. Each is a DV= 1, with the pre-1986 cohort being the default (DV=0)
Industry variables	20 industries (19 DVs)
Age	Age in years
Degree	Highest degree outside of Canada or the US (DV=1), 0 if in Canada

DV stands for dummy variable.

The data used in this paper are drawn or constructed from the public-use micro-data 2006 census file for individuals. Our estimating samples are restricted to individuals, both immigrants and Canadian-born who are 25-64 years of age, who were working full-time, full-year in the census year. These samples were used to estimate the two-tier wage frontier with the Groot and Oosterbeek (1994) extension mentioned in the previous section. Given the disproportionately large number of Canadian-born individuals, we restricted their number to a 30 percent random sample. Table 2 provides summary statistics of some of variables used in this paper.

The Results and Discussion

The maximum likelihood estimates of the parameters of the two-tier wage frontier system given by equations (2) and (6) are presented in Table 3. For brevity, we have not reported the estimates of the Groot-Oosterbeek parameterization. Overall, the earnings functions

estimates are generally in line with expectations and are highly significant at the 5 percent level (or less). Thus, among the Canadian-born, the returns to a high school, bachelors or masters or higher level of education are respectively 17%, 39% and 51% greater than those of individuals with a less than high school education. Among immigrants who obtained their degree in Canada, the wage

Table 2: Summary Sample Statistics

	Canadian born	**Immigrants**
HS - (%)	10.3	10.8
HSCert + (%)	66.5	55.0
Bac + (%)	18.2	23.9
Mas + (%)	4.9	10.3
Manag (%)	13.7	12.6
Profs(%)	27.1	29.0
Super (%)	11.1	8.2
Skint (%)	25.0	24.8
Cler (%)	11.0	10.5
Man (%)	11.6	14.5
Wages ($ per week)	1013.6	968.2
CMA residents (%)	65.1	93.6
Age (years)	42.7	45.0
Immigrants (%)		
2000-2006 arrival cohort	*	10.6
1996-2000 arrival cohort	*	13.1
1991-1996 arrival cohort	*	14.6
Pre-1991 arrival cohort	*	39.0
Highest degree in Canada	*	39.0

See Table 1 for definitions.

advantage of the educated is much more muted, with the corresponding returns being 15%, 22% and 35% respectively higher than those without a high school degree. If their degree was obtained prior to migration, the returns to higher education are substantially reduced,

given that the coefficient of the interaction terms in the immigrant regression is negative. This confirms the difficulty in transferring immigrant human capital to Canadian labour markets. The regressions also show that Canadian-born and immigrant women earn about 25-28 percent less than men, ceteris paribus, and that older individuals with greater experience earn more, but this effect declines with age. It is also evident that, among both the Canadian-born and immigrants, those in management occupations earn about 10-15 percent more than professionals, while those in all other occupations earn less. Manual and clerical workers earn relatively the least relatively.

Worker and Employer Wage Gaps by Industry

Table 4 depicts the average wage resulting from worker and employer imperfect information, as well as the overall wage from the interaction of the two, for Canadian-born and immigrant workers in the aggregate, as well as across selected industries. In the estimates given here, to capture inter-industry variations, we look at CMA residents who are 35 years of age. For immigrants, we consider those whose highest degree was obtained in Canada (and who know at least one official language). At the aggregate level, worker information gaps appear to be very similar for Canadian-born and immigrants workers, leading to a shortfall in wages in the 30 percent range relative to full-information wages. Employer imperfect information is seen to result in an average wage overpayment of about 34-39 percent for native-born and immigrants. On balance, these two opposing gaps produce an overall average wage shortfall that is 2-5 percent lower than the average full-information wage. In a sense, the larger employer ignorance with respect to immigrants works to the advantage of the latter, and sufficiently to substantially cut the wage shortfall from worker ignorance.

Table 3: Maximum Likelihood Estimates of the Two-tier Wage Frontier

Variable/Parameter	Canadian born	Immigrants
Constant	5.36	5.85
	(144.9)	(114.9)
HSCert+	0.1732	0.1506
	(24.2)	(17.2)
Bac+	0.3892	0.2232
	(44.9)	(19.9)
Mas+	0.5080	0.3478
	(46.0)	(24.8)
(Bac+) x Degree		-0.1308

	*	(-12.2)	
(Mas +)x Degree		-0.1162	
	*	(-7.74)	
Manag	0.1516	0.1071	
	(22.8)	(12.8)	
Super	-0.1444	-0.1479	
	(-19.4)	(-14.5)	
Skint	-0.1797	-0.3145	
	(-29.3)	(-41.5)	
Cler	-0.2750	-0.3027	
	(-37.3)	(-32.4)	
Man	-0.2731	-0.3939	
	(-33.6)	(-43.1)	
Female	-0.2542	-0.2824	
	(-42.4)	(-38.0)	
CMA	0.0713	-0.319	
	(11.7)	(-2.02)	
Age	0.0644	0.0465	
	(37.7)	(21.5)	
Age-squared	-0.0006	-0.0004	
	(-32.1)	(-17.6)	
(1/σ)	6.32	6.10	
	(36.9)	(29.9)	
Sample size	48,219	36,776	
Log-Likelihood	-35,344		-29,428

Numbers in parentheses are asymptotic t values. All coefficients are statistically significant at the

5 percent level or less.

A more disaggregated view points to some similarities between the two groups. Specifically, the wage shortfall due to worker ignorance is highest in agriculture, construction and retail

trade for both groups, ranging from 40-44 percent in agriculture to about 37 percent in retail trade and about 32 percent in construction. For all other industries, the gaps are smaller and very similar for both groups. However, a major difference between the two groups relates to the variability of those gaps. Specifically, there is much more variability in worker wage gaps among immigrants within each industry, than among Canadian-born workers, likely reflecting a greater diversity among the former in terms of length of residence in Canada. This also means that search outcomes are more uncertain among immigrants, pointing to variations across individuals in terms of the costs of search.

Table 4: Average Wage Gaps with Worker & Employer Ignorance in Selected Industries[a]

Industry	Canadian born			Immigrants		
	Worker ignorance	Employer ignorance	Worker & Employer ignorance	Worker ignorance	Employer ignorance	Worker & Employer ignorance
All	70.7	133.7	94.7	69.9	139.3	97.7
	(6.1)	(13.6)	(14.1)	(4.9)	(17.8)	(16.4)
Agriculture	55.8	145.9	81.4	60.1	131.5	79.3
	(0.9)	(2.6)	(0.2)	(3.7)	(4.8)	(16.4)
Construction	68.1	143.0	97.4	66.9	169.2	113.5
	(0.3)	(1.6)	(0.6)	(2.2)	(15.8)	(13.4)
Manufacturing	74.3	141.9	105.4	71.8	143.6	103.3
	(0.3)	(2.0)	(1.1)	(1.8)	(8.5)	(8.2)
Retail trade	62.5	124.2	77.3	63.3	129.5	82.1
	(0.7)	(0.8)	(0.4)	(3.3)	(4.2)	(6.4)
Finance& Real Estate	72.3	139.6	100.8	71.1	144.0	103.2
	(5.0)	(2.4)	(6.4)	(3.4)	(8.9)	(9.9)
Education	74.4	114.7	85.3	71.8	123.1	88.4
	(0.3)	(0.3)	(0.2)	(2.1)	(2.5)	(4.1)
Health	70.1	121.1	84.9	70.0	130.8	91.7
	(0.4)	(0.5)	(0.1)	(2.6)	(4.3)	(5.2)

[a] These estimates are expressed as percentages, and are obtained for individuals aged 35 years living in CMAs. The numbers in parentheses are standard deviations.

We turn next to wage gaps by industry resulting from employer imperfect information. There is a clear difference between Canadian-born and immigrants here. The wage gaps are clearly larger among immigrants in all industries except agriculture. The gaps range from 15-46 percent among Canadian-born workers to 23-69 percent for immigrants across industries. These gaps are relatively small in service industries like education and high in agriculture and construction for both groups. Once again, it is clear from the table that employer gaps vary much more significantly among immigrants in all industries compared to Canadian-born workers. The finding that employer gaps amongst immigrants are in general larger and show far greater variability in all industries is a plausible one, and suggest that employers are better able to assess the credentials of Canadian-born than those of a diverse group of immigrants.

Table 4 also gives estimates of the overall wage gaps resulting from the interaction of employer and worker imperfect information. Since the two pull in different directions, the overall gaps are more muted than those suggested by worker or employer information gaps alone. It is interesting to note that in some industries (finance and real estate, and manufacturing) both immigrant and Canadian-born wages are on average just above the full-information wage. For immigrants the average wage is in fact a full 13 percent higher than the full-information wage in construction. In other industries there is an overall wage shortfall, and it is quite large, ranging from 15 to 20 percent. It is again worth noting the much greater variability among immigrant workers, pointing to the greater uncertainty associated with their wage outcomes.

Language, the Transferability of Human Capital and Immigrant Wage Gaps

We have noted in the previous section that there are several factors that make the immigrant experience in labour markets different from that of the native-born. Their positive selectivity makes them more likely to find suitable job matches, but the imperfect transferability of their skills makes that more difficult, especially when they are new to the host country. In Table 5 we present some additional findings that take into account immigrant-specific factors that impact on labour market efficiency. The first three rows show the wage gaps resulting from information gaps due to differences in the transferability of human capital and language ability. The first row relates to immigrants who acquired their highest degree abroad, but who possess knowledge of at least one official language. For this group, the average wage shortfall due to worker ignorance places them about 33 percent below the full-information wage, while the employer wage gap is in the opposite direction by about the same relative magnitude. If we then shift to immigrants who also acquired their degree aboard but do not know at least one official language (second row), the shortfall rises to almost 38 percent, while employers would pay on average only 15 percent more. The widening of the worker information gaps is in line with expectations.

The narrowing of the average employer wage gap can be explained several factors. One is that, faced with potential employees with a certain skill, but who lack knowledge of an official

language, employers are likely to be relatively more certain in their wage offers since they might see the lack of language skills as a signal of low quality and hence wage offers would uniformly be on the low side. Secondly, these workers themselves might seek employment in ethnic markets where employers likely have greater information about workers. Both these factors are likely to be mutually reinforcing and would tend to make it easier for employers to pry out information on reservation wages. As is evident from the table, the combination of lower information on the part of employers and workers together mean that wages on balance are pulled down a large 28 percent below the full-information wage, compared to just 11 percent for those immigrants who do possess the language skills.

If we then compare both groups of immigrants with those who acquired their degree in Canada and who also have the language skills (third row), we see that the wage gap on the employee side is reduced to 30 percent while the wage gap on the employer side jumps to 39 percent. These differences keep the overall wage gap just 2 percent below the full-information wage. This third group of immigrants is, of course, closer in human capital characteristics to the Canadian-born, so that their wage gaps match fairly closely those of the latter as we saw in Table 4.

Another immigrant-specific factor of interest is the length of residence in Canada. How does this interact with the transferability of human capital to determine wage gaps? To assess this, we can compare new immigrants (those who arrived in the country within the previous five years at the 2006 census) with those who came at least 15 years ago, again taking into consideration whether their degree was obtained in Canada or abroad, and whether they posses the language skills. Starting with new immigrants, who acquired their degree prior to migration, but who do know one official language, we can see from Table 5 that the worker wage gap rises to 39 percent, compared to 33 percent observed for all immigrants. The gap on the employer side shrinks to 24 percent compared to 33 percent for all immigrants. This combination of shifts pulls the overall wage about 24 percent below the full-information frontier compared to just 11 percent for all immigrants. However, if these workers additionally lack language skills, the average wage gap from worker ignorance jumps to 44 percent, while the gap due to employer ignorance narrows to just 13 percent. This combination pulls their overall wage down 37 percent below the full-information wage, compared to 28 percent for all immigrants.

Table 5: Immigrant Average Wage Gaps with Worker & Employer Ignorance[a]

	Worker ignorance	Employer ignorance	Worker & Employer Ignorance

All Immigrants			
Education abroad plus language	66.9	132.5	89.1
	(5.8)	(12.2)	(14.0)
Education abroad only	62.2	114.6	71.6
	(8.2)	(3.4)	(11.0)
Canadian education plus	69.9	139.3	97.7
language	(4.9)	(17.8)	(16.4)
New Immigrants			
Education abroad plus language	61.2	123.7	75.9
	(6.4)	(5.1)	(9.8)
Education abroad only	55.6	112.9	62.9
	(8.8)	(2.3)	(10.9)
Canadian education plus	63.1	124.3	78.5
language	(5.8)	(5.70	(9.0)
Established Immigrants			
Education abroad plus language	70.2	135.5	97.2
	(4.4)	(13.6)	(13.3)
Canadian education plus	71.1	143.1	101.9
language	(4.2)	(18.9)	(16.3)

[a] See notes to Table 4.

The preceding discussion suggests that language ability is an important factor in determining overall wage gaps for immigrants who acquire their education abroad, especially when they are new to the country. If new immigrants acquired their degree in Canada, then along with language skills, they fare better as Table 5 shows. Now their wage gap due to worker imperfect information is smaller at 37 percent, and employer imperfect information pushes the wage gap up to 24 percent, so that on balance, the average wage is now a much smaller (though still relatively large) 21 percent below the full-information wage. In other words, wage gaps work to a greater disadvantage for new immigrants compared to immigrants as a whole, regardless of their degree or language skills, although matters are worse if a degree is acquired abroad, especially when a language disability exists.

Finally, we look at established immigrants, who have been in Canada for at least 15 years (the last two rows of Table 5). For this group, we consider two cases: one where they acquired their degree in Canada, and a second where this degree was acquired prior to migration. In both cases, it is reasonable to assume that established immigrants possess language skills. In both these cases, it is clear from the table that there is a small difference in worker wage gaps, and a larger wage gap driven by employer information gaps. On balance, if the degree is acquired abroad, the overall wage gap is a small 3 percent, and if the degree is acquired in Canada, that gap is just 2 perecnt. These results are close to those found for Canadian-born workers as a whole.

IV. CONCLUSION

This paper empirically examined how imperfect information on the demand and supply side of Canadian labour markets lead to wage gaps, using a two-tier stochastic wage frontier. This frontier is the empirical counterpart of a model of competitive labour markets with imperfect information. The frontier is estimated from data taken from the 2006 census to answer two broad questions. First, how do wage gaps due to worker and employer imperfect information differ across industries for Canadian-born and immigrant workers? Second, how does the transferability of the human capital of immigrants and the length of residence in Canada interact with language ability to determine those gaps?

Our findings show that Canadian-born and immigrants with similar characteristics tend to experience quite similar wage gaps in the aggregate. While those gaps show significant variation across some industries for both immigrants and Canadian-born workers, and wage gaps due to worker imperfect information are also similar both groups, wage gaps driven by employer imperfect information are much larger among immigrants. As well, the results clearly show that the variability in the amount of information that workers and employers possess is clearly more substantial among immigrants, thereby pointing to greater uncertainty about their wage outcomes.

As well, our analysis of immigrants shows that while the effects of acquiring their degree prior to migration increases the size of wage gaps due to employer and worker imperfect information, these impacts are relatively modest when compared to those arising from a lack of language skills. If immigrants lack those skills, the wage gaps due to worker ignorance rise substantially, while there is a sharp reduction in the wage gaps from employer ignorance. The effect of this is to substantially pull wages below the full information wage. The impacts are even sharper among new immigrants, while established immigrants experience gaps much more in line with those of the native-born. The significantly narrower employer gaps due to a language disability than to a foreign degree means that employers have less uncertainty about immigrant workers when they lack language skills than when they have a foreign degree. This likely means that not having the language skills is taken as signal of low quality and leads to uniformly low wage offers by a majority of employers; rating a foreign degree, on the other hand, is likely to be a more difficult and uncertain matter.

These results are preliminary, and the robustness of the findings would require further testing. In this regard, specification tests would be especially important because in the frontier approach, incomplete information is measured from residuals, and is likely be sensitive to model specification. It is also important to keep in mind that the model of the labour market used here ignores other likely motives underlying labour market behaviour. For example, employers may pay higher than the minimum wage for efficiency-wage reasons, not because they lack information. Similarly, workers may accept low wages not so much because they lack information about offers, but rather because the non-recognition of foreign-acquired credentials, which has become a serious issue in Canada in recent times, effectively blocks of certain jobs to immigrants, especially those of the non-traditional kind.

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